NOTES ON NEMATODES OF THE GENUS *PHYSALOPTERA*, WITH SPECIAL REFERENCE TO THOSE PARASITIC IN REPTILES.

Part i.

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The genus *Physaloptera* was established by Rudolphi in 1819, to include five species separated from the genus *Spiroptera*. It is characterised by the presence of two lateral lips armed with teeth at the extremity, and, in the male, a closed lanceolate bursa, embracing the base of the tail and bearing four pairs of pedunculated papillae, in addition to a variable number of other papillae.

Two monographs have been published on it, both in Italian, one by Molin in 1860, and the second by Stossich in 1889. Rudolphi in his original diagnosis, had shown some doubt about his classification ("Alias enim artificiosum esse facile concedo", Entoz. Synop., p. 236), and, in consequence of this, Dujardin, in 1845, suppressed the new genus, and reunited all its species, provisionally, with the genus *Spiroptera*, "en attendant que toutes les espèces soient suffisamment connues pour qu'on puisse établir, d'après leur organisation plusieurs coupes génériques" (Hist. nat. d.'Helm., p. 83). Its definite reestablishment is due to Diesing who published a well-defined diagnosis in 1851, and repeated it, with some slight additions, in 1857 (p. 16). In his "Revision der Nematoden," published in 1860, after the appearance of Molin's monograph, he gave a further amended diagnosis:—"Corpus elongatum teretiusculum. Caput corpore continuum, bilabiatum, labiis externe papillis exornatis, interne dentibus armatis. Os ad basin labiorum. Extremitas caudalis maris utrinque alata, alis inflatis antice vesica conjunctis, ad aperturam genitalem quadricostatis. Penis vagina monopetala. Apertura genitalis feminea in anteriore corporis parte; uterus bicornis. Ovipara. Mammalium, Avium et praecipue Amphibiorum: in oesophago et ventriculo, rarius in intestinis, rarissime in cavo orbitae endoparasita." Since that date the validity of the genus has never been questioned, Schneider rightly remarking (1866, p. 59) that *Physaloptera* is one of the best of Rudolphi's genera.

Diesing used the term "Amphibiorum" in the original Linnean sense, which did not distinguish between Amphibia and Reptilia. None of the species known at that time had been found in Amphibia, and, with a single exception, all the species recorded up to the present have been found in the higher Vertebrates, carnivorous species of mammals, birds and reptiles. They are almost invariably found in the alimentary canal.

Statistics given by the early helminthologists show what was known, at the time of writing, of the distribution of the species among the various hosts. It is summarised here in tabulated form.

Author	Total number of known spp of hosts.	Distribution.		
Rudolphi (1819) ...	7	1 mammal	4 birds	2 reptiles
Diesing (1851)	53	12 ,,	32 ,,	9 ,,
Molin (1860)	73	22 ,,	21 ,,	30 ,,
Stossich (1889)	104	27 ,,	40 ,,	37 ,,

Molin states that of the 73 hosts which he recorded, only eight were European, the remaining sixty five being exotic, the majority of them American. Twenty nine years later, Stossich gives the distribution of recorded species of Physaloptera as 7 in Europe, 4 in Asia, 1 in Africa, and 28 in America.

Diesing in 1851 had included 13 species in the genus, four of which he regarded as doubtful; Molin enumerated 22, after excluding four of Diesing's species, and including four doubtful ones; Linstow (1878) recorded 31 species, and Stossich (1889) 37, eleven of them doubtful. Of these thirty seven, 15 were found in mammals, 11 in birds, and 11 in reptiles. Between 1889 and 1906 eighteen new species were catalogued in the Zoological Record. This brought the total number of recorded species up to 55, of which 25 occurred in mammals, 14 in birds, 15 in reptiles, and 1 in an amphibian. This number, of course, includes doubtful species. Linstow at this date (1906) gives the number as 20 in mammals, 12 in birds, and 14 in reptiles. Twenty one new species appear in the Zoological Record between 1906 and 1918, and the total number of specific names recorded altogether, up to the end of 1918 is seventy seven, 34 in mammals, 18 in birds, 24 in reptiles, and 1 in a frog. The complete list is given on p. 494, with dates of those species which were proposed as new after the appearance of Stossich's monograph.

On the species parasitic in Reptiles.

Of Rudolphi's original species, two, *P. abbreviata* and *P. retusa*, were found in reptiles, both of them in lizards, and until the appearance of Diesing's Syst. Helm. in 1851, these were still the only species known from this class. Diesing described as a third species, *P. mucronata*, from the alligator, and placed Rudolphi's *Strongylus colubri* in the same genus, among the "species inquirendae," but Molin considered *P. mucronata* to be an Ascarid, and subsequent writers follow him in excluding it from the list of *Physaloptera*. In 1882, Drasche examined and published a revision of the types of Diesing's and Molin's species, and pronounced *P. mucronata* to be a synonym of *Ascaris lanceolata* Molin; but he included *P. colubri* as a valid species. Three other of the early species, all Leidy's, *P. abjecta*, *P. constricta*, and *P. contorta*, are insufficiently characterised, and are regarded by both Molin and Stossich as doubtful species. Of the other species which make up the list of eleven recorded by Stossich, two were added by Molin, one, *P. spiralis*, by Schneider in 1866, and two, *P. dentata*, and *P. striata*, by Linstow in 1883.

The number of species recorded from reptiles has been more than doubled since that time, but no complete review of the whole group has been published since the date of Stossich's monograph. The amount of work now involved in the search through scattered literature before any systematic work can be undertaken, makes such a review urgently necessary.

Although *Physaloptera* has been met with fairly frequently in Australian reptiles, and is known to be widely distributed, only two definite specific records

have been contributed to Australian reptilian helminthology. Linstow, in 1899, described as a new species *P. antarctica*, from a lizard and a snake in South Australia; and Stossich, in 1902, *P. alba*, from *Cyclodus boddaertii*, "Nuova Olanda." It is curious to find this century-old name used as late as 1902, but a reference to the literature relating to the host affords some explanation of it. In the original description, in 1839, Duméril says "Le Cyclode de Boddaert habit la Nouvelle Hollande, et à ce qu'il parait aussi l'île de Java, car nous en avons reeu du musée de Leyde un exemplaire portant l'indieation qu'il provenait des recoltes faites dans eette ile par Kuhl et Van Hasselt." These lizards from Java and Australia are now recognised as two distinct species, viz.:—*Tiliqua gigas* and *Tiliqua scincoides*. As the locality for the Nematodes is given as New Holland, it seems probable that the host from which they were taken was one of Duméril's specimens from Australia, not from Java, i.e., that it was *Tiliqua scincoides*, though Stossich himself does not give any explanation of the record.

Distribution of Physaloptera species.

In Mammals.

anomala Molin
brevivaginata Seurat, 1917
brevispiculum Linstow, 1906.
caucasia Linstow, 1902
cesticillata
circularis Linstow, 1897
clausa Rudolphi
coelebs Linstow, 1897
digitata Schneider
dilatata Rudolphi
elegantissima Stossich, 1902
gemina Linstow, 1899
getula Seurat, 1917
ineurva Linstow, 1908
inermis Linstow, 1906
limbata Leidy
magnipapilla Molin
maxillaris Molin
mordens Leiper, 1907
muris brasiliensis Diesing
nasilionis Gedoelst, 1917
numidica Seurat, 1917
papilloradiata Linstow, 1899
papillotruncata Molin
pyramidalis Linstow
ruwenzori Parona, 1907
semilanceolata Molin
sciuri Parona, 1898
spirula Hempr.
tacapensis Seurat, 1917.
terdentata Molin
torquata Leidy
tumefaciens Henry & Blanc, 1912
turgida Rudolphi

In Birds.

acuticauda Molin
alata Rudolphi
„ var. *chevreuxi* Seurat, 1915
„ var. *nouveli* Seurat, 1915
bilabiata Creplin
brevicauda Linstow 1909
bulbosa Linstow, 1906
crassa Linstow
crosi Seurat, 1915
fusiformis Linstow, 1902
galinieri Seurat, 1915
inflata Molin
malleus Linstow
ovata Linstow, 1907
rotundata Linstow, 1906
saginata Rudolphi
striata Linstow
strongylina Rudolphi
tenuicollis Rudolphi
truncata Schneider

In Amphibia.
(*Rana macrodon*)
amphibia Linstow, 1899

In Reptiles.

abbreviata Rudolphi
abjecta Leidy
affinis Gedoelst, 1916
alba Stossich, 1902
aloisii-sabaudiae Parona, 1907
antarctica Linstow, 1899
britanica Skrjabin
chamaeleontis Gedoelst, 1916
colubri Rudolphi
constricta Leidy
contorta Leidy
dentata Linstow
leptosoma Seurat (Gervais), 1917
monodons Molin
mucronata Diesing
obtusissima Molin
pallaryi Seurat, 1917
paradoxa Linstow, 1908
quadrovaria Leiper, 1908
retusa Rudolphi
sousinoi Linstow, 1895
spiralis Schneider
striata Linstow
varani Parona, 1890.

Krefft had already, in 1871, mentioned the occurrence of a *Physaloptera* sp. in *Cyclodus* (*Tiliqua*) *gigas*, but did not describe or name it. T. H. Johnston, taking the Australasian zoogeographical region in its wider sense, to include the East Indies, included Krefft's record in his "Census of Australian Reptilian Entozoa" (1912), and also three species collected by Dr. Willey in the Western Pacific Isles, and identified by Shipley (1900) as *Physaloptera obtusissima, P. retusa,* and *P. varani.* The two former were found in the intestine of a snake, *Dipsadomorphus irregularis,* the latter in the stomach of *Varanus indicus.* It was described originally from specimens taken from the stomach of *Varanus bengalensis* at Palon, Pegu, in South Burma, but has since proved to be widely distributed, extending as far as Northern Africa; and Johnston has indicated its probable occurrence on the mainland of Australia. In 1909 he wrote "I have seen *Varanus indicus* near Gladstone in Queensland, and hence it may be expected that before long . . . *Physaloptera varani* . . . may be added to our known Australasian entozoan fauna." In the same paper (1909*a*) he records "a few specimens of a Nematode, *Physaloptera* sp., perhaps *P. varani* Parona" as found, in addition to a Cestode, in the stomach of *Varanus varius,* the common tree "goanna," obtained near Bathurst, N.S.W.; and later (1912*a*) records the same species from *Varanus gouldii,* the sand "goanna," collected in Queensland, Western Australia, Victoria, and New South Wales, and from *Varanus bellii* collected at Eidsvold, Burnett River, Queensland (1912*b*). In the Census of Endoparasites in Queensland (1916) the same species is again referred to as found in these three species of *Varanus.*

These records are not accompanied by figures or descriptions, and in every case they are queried, Dr. Johnston stating that he had not yet seen a description of *P. varani,* and consequently could not identify it with certainty.

All the other Australian records consist of the mere mention of unidentified species of *Physaloptera* found in various hosts of the orders Lacertilia and Ophidia. They relate chiefly to a series of exhibits made by Dr. Johnston in 1909 and 1910, before the Royal Society of N.S.W., and this Society, of specimens taken from the brown snake, tiger snake, and whip snake, and from the blue-tongued lizard (*Tiliqua scincoides*), tree goanna, slow worm (*Lialis burtonii*) and *Lygosoma* (*Hinulia*) *tenue,* all from New South Wales. There is, in addition, another record by Krefft (1871) of a *Physaloptera* sp. from *Diemenia reticulata.* He does not give the locality from which they were taken, but according to Dr. Johnston, who says he had inspected Krefft's material, and similar specimens collected by Dr. Cleland in the North West, the parasites from this "spinifex snake" came from Western Australia.

From the above records, it will be seen that, up to the present time, representatives of the genus in Australia have been recorded, in Ophidia, from three species of *Diemenia,* and from one species each of *Acanthophis, Dipsadomorphus* and *Notechis;* and, in Lacertilia, from four species of *Varanus,* three species of *Tiliqua,* and one species each of *Lygosoma* and *Lialis.*

But the vagueness of the records is evidence of the difficulty experienced by workers in getting access to the literature which would make specific identifications possible.

In the collection of parasitic Helminths made for the Bureau of Microbiology of New South Wales by Dr. J. B. Cleland over a period of ten years, there are numerous Nematodes from our native fauna. Through the kindness of Dr. Cleland I have had the opportunity of examining that part of it taken from reptiles, and find it to consist in large proportion of *Physaloptera.* The labels on the phials indicate that the hosts among Lacertilia were *Lialis burtonii,*

Gymnodactylus laturus, *Varanus* sp., and *Hinulia* sp.; and among Ophidia, "black snake" (5 collections), "whip snake" (2 collections) "brown snake" (1 collection), and "snake, Flinders Is." (2 collections). None of these collections of *Physaloptera* has been recorded hitherto, and all the specimens still await identification.

The present work was undertaken with the intention of making a report on them, and on various specimens which have from time to time been brought under my notice from dissections of reptiles in the Zoology Department of the Sydney University. But while endeavouring to gather together the scattered and fragmentary descriptions of known species, it has seemed to me that the information so collected should be made more readily available to workers than it has been hitherto, and that a brief general survey of the *Physaloptera* of reptiles would be useful.

With this end in view, I have compiled a systematic index of all the known reptilian hosts, with the species parasitic in each, grouped under the different orders of reptiles in which they have been found. Every recorded species of the parasites has been included, whether the original description is well defined or doubtful, and without regard to the question of synonymy. These matters will be dealt with later, when the groups are considered in detail. But the hosts have been recorded, as far as possible, under the names accepted in the British Museum Catalogue of Reptiles (1885-1896), since many of the early synonyms, under which the hosts appear in the original records are not readily recognisable, and are difficult to trace. However, those names which it is impossible to identify now are given in the original form, though they must be regarded as *nomina nuda*. This is the case with many of the hosts enumerated by Molin, including most of Fitzinger's species.

The bibliographical catalogue, which follows the host list, is as full as it is possible to make it with the literature available to me; but many of the scientific periodicals required are not possessed by our libraries, so the catalogue must necessarily be regarded as incomplete.

As the new genus *Thubunaea*, which was established by Seurat in 1914, is very closely related to *Physaloptera*, I have added it to the catalogue. The single species, *Thubunaea pudica*, is a reptilian parasite, being found in the stomach of a Chamaeleon, and in two snakes, *Cerastes vipara* L. and *Scincus officinalis* Laur., in Northern Africa.

Host list for Physaloptera *parasitic in Reptiles.*

CHELONIA.

P. contorta.	*Chrysemys reticulata* Daud., *Chrysemys scripta* Shoepff., *Cistudo carolina* Linn., *Cinosternum pennsylvannicum* Wagl.
P. sp.	*Emys venusta* Gray.

CROCODILIA.

P. mucronata.	*Alligator missisipiensis* Gray, *Caiman niger* Spix.

OPHIDIA.

P. abbreviata.	*Tropidonotus tessellatus* Laur., *Ciconia alba* (pseudo parasite, swallowed with reptiles).
P. abjecta.	*Zamensis flagelliformis* Laur.
P. affinis.	*Psammophis sibilans* Linn.
P. antarctica.	*Acanthophis antarcticus* Shaw.
P. colubri.	*Coronella austriaca* Laur.

P. constricta.	*Tropidonotus fasciatus* Linn.
P. dentata.	*Vipera berus* Linn.
P. monodons.	*Boa constrictor* Linn.
P. obtusissima.	*Dipsadomorphus irregularis* Merrem, *Erythrolamprus aesculapii* Linn., *Lachesis lanceolatus* Lacep., *Oxyrhopus cloelia* Daud., *Spilotes pullatus* Linn., *Xenodon severus* Linn., ? *Lygophis regius* Fitz., ? *Ophis coeruleus* Fitz., ? *Ophis rhodogaster* Fitz., ? *Ophis treuensteinii* Fitz., ? *Oxyrhopus fasciatus* Fitz., ? *Pseudophis cinerascens* Fitz.
P. paradoxa (larva).	*Bitis cornutus* Daud.
P. retusa.	*Dipsadomorphus irregularis* Merrem.
P. striata.	*Tropidonotus tessellatus* Laur., *Ciconia alba* (pseudo parasite, probably taken in with reptile food).
P. sp.	*Demansia* (or *Diemenia*) *reticulata* Gray.
P. sp.	*Demansia* „ „ *psammophis* Schl.
P. sp.	*Demansia* „ „ *textilis* Dum. & Bibr.
P. sp.	*Notechis scutatus* Peters.
P. sp.	"un ofidio" Monte Carin, Cobapo. (Parona 1890).
P. sp.	"A large snake" Bismark Archipelago. (Linstow 1897).

LACERTILIA.

P. abbreviata.	*Lacerta agilis* Linn., *Lacerta muralis* Laur., *Lacerta ocellata* Daud., *Lacerta viridis* Daud., *Lacerta vivipara* Jacq., *Ophisaurus apus* Pall. (*syn.* Pseudopus pallasii Cuv.), *Phrynocephalus helioscopus* Gray, *Phrynosome regale* Girard, ? *Chrysolamprus ocellatus* Fitz., ? *Lacerta margaritacea* Spix., ? *Phrynosoma hernandesii* Gray (Phrynosoma douglassi Gray ?).
P. alba.	*Cyclodus boddaertii* Dum. & Bibr. (Tiliqua scincoides or Tiliqua gigas).
P. aloisii-sabaudiae.	*Agama atricollis* Smith.
P. antarctica.	*Tiliqua occipitalis* Gray.
P. chamaeleontis.	*Chamaeleon gracilis* Hallowell.
P. dentata.	*Agama sanguinolenta* Pallas, *Phrynocephalus mystaceus* Pallas, *Agama mutabilis* Merrem (?).
P. leptosoma.	*Uromastix acanthinurus* Bell, *Varanus griseus* Daud.
P. pallaryi.	*Agama bibronii* Dumeril.
P. paradoxa.	*Varanus griseus* Daud., "A Chamaeleon."
P. quadrovaria.	*Varanus niloticus* Gray.
P. retusa.	*Ameiva surinamensis* Laur., *Amphisbaena alba* Lin., *Ophiodes striatus* Strix., *Pygodactylus gronovii* Merr., *Scleroporus undulatus* Merr., *Tropidolepideura* sp., *Tropidurus torquatus* Neu., *Tupinambis nigropunctatus* Spix., *Tupinambis teguixin* Lin., ? *Euprepis spixii* Fitz., ? *Podinema scripta* Fitz., ? *Podinema graphica* Fitz.
P. sonsinoi.	*Agama mutabilis* Merrem.
P. spiralis.	*Amphisbaena* sp.
P. varani.	*Varanus bengalensis* Daud., *V. griseus* Daud., *V. indicus* Daud., *V. bellii* D. & B. (?), *V. gouldii* Gray (?), *V. varius* Shaw (?).
P. sp.	*Lialis burtonii* Gray.
P. sp.	*Lygosoma* (*Hinulia*) *tenue* Gray.
P. sp.	*Tiliqua scincoides* White.
P. sp.	*Tiliqua gigas* Schn.
P. sp.	*Varanus gouldii* Gray.
P. sp.	*Varanus varius* Shaw.

Bibliographical catalogue of the Physaloptera *of Reptiles.*

Physaloptera abbreviata Rudolphi.

1819, *Ascaris fallax*, Rudolphi, Synops., pp. 40, 279.—1845, Dujardin, Hist. nat. des Helm., p. 176 and p. 104 (*Spiroptera abbreviata*).— 1819, *Physaloptera abbreviata*, Rudolphi, Synops., pp. 30, 257.—1851, Diesing, Syst. Helm., ii., p. 235.—1860, Molin, Sitz. d. k. Akad. d. Wiss. Wien, xxxix., p. 646.—1866, Schneider, Monog. d. Nemat., p. 65.—1878, Linstow, Comp. d. Helm., p. 192.—1883, Linstow, Arch. f. Naturg., pp. 281-282, taf. vi., figs. 7, 8.—1863, Leuckart, Paras. d. Menschen, ii., aufl. 1, p. 89.—1886, Linstow, Worms; Travels Fedtschenko (lav. russo). Mosca, p. 6, figs. 7-8.—1886, Leidy, Proc. Acad. Nat. Sc. Philadelphia, p. 312.—1889, Linstow, Compend. d. Helm., Nacht., p. 66.—1887, Parona, Ann. Mus. Genova, xxiv., 2, vol. iv., pp. 275, 483.—1889, Condorelli, Boll. Soc. rom. studi zool., viii., an. 8, fasc. 3-5, pp. 127-133.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., pp. 42-43.—1912, Parona, L'Elmintol. Italiana, ii., p. 113.—1914, Seurat, C.R. Soc. Biol., lxxvii., p. 433-434, figs. 2, 3.—1916, Ransom, Proc. U.S. Nat. Mus., 50, pp. 214-215, figs. 279, 280.—1917, Seurat, C.R. Soc. biol., Paris, lxxx., pp. 44-45.

Physaloptera abjecta Leidy.

1856, Leidy, Proc. Acad. Philadel., viii., p. 53.—1857, Diesing, Denk. k. Akad. Wiss. Wien, Math. Natur. Cl. xiii., p. 11.—1860, Molin, Sitz. Akad. Wiss. Wien, Math.-Natur. Cl., xxxix., p. 665.—1878, Linstow, Compend. d. Helm., p. 186.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 51.

Physaloptera affinis Gedoelst.

1916, Gedoelst, Rev. Zool. Afric., v., p. 55, text-fig. 17.

Physaloptera alba Stossich.

1902, Stossich, Boll. Mus. Genova, No. 116, pp. 10-11, Pl. iv., figs. 18-20.

Physaloptera aloisii-sabaudiae Parona.

1907, Parona, Torino Boll. Musei Zool. anat., xxii., No. 566, p. 3.—1917, Seurat, C.R. Soc. biol., Paris, lxxx., p. 47.

Physaloptera antarctica Linstow.

1899, Linstow, Mitt. Zool. Samm. Mus. Berl., i., (2), p. 15, Pl. iii., fig. 39.—1912, Johnston, Proc. Roy. Soc. Q'land., xxiii., p. 240, 243.

Physaloptera britanica Skrjabin.

1917, Seurat, C.R. Soc. biol., Paris, lxxx., p. 47.

Physaloptera chamaelcontis Gedoelst.

1916, Gedoelst, Rev. Zool. Afric., v., p. 53, text-fig. 16.

Physaloptera constricta Leidy.

1856, Leidy, Proc. Acad. Philad., viii., p. 53.—1857, Diesing, Denk. k. Akad. Wiss. Wien, Math.-Natur. Cl., xiii., p. 11.—1860, Molin, Sitz. k. Akad. Wiss. Wien, Math.-Natur. Cl., xxxix., pp. 663-664.—1878, Linstow, Compend. d. Helm., p. 188.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 52.

Physaloptera colubri Rud.

1819, *Strongylus colubri*, Rudolphi, Synops., p. 37.—1851, *Physaloptera colubri*, Diesing, Syst. Helm., p. 237.—1860, Molin, Sitz. k. Akad. Wiss. Wien, xxxix., p. 665.—1878, Linstow, Compend. d. Helm., p. 190.—1882, Drasche,

Verh. Zool.-bot. Gesellsch. Wien, xxxii., p. 128, tab. viii., figs. 19-20.—1889, Linstow, Compend. d. Helm., Nacht., p. 65.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 42.

Physaloptera contorta Leidy.

1856, Leidy, Proc. Acad. Philad., viii., p. 53.—1857, Diesing, Denk. k. Akad. Wiss. Wien, xiii., p. 11.—1860, Molin, Sitz. k. Akad. Wiss. Wien, Math.-Natur. Cl., xxxix., p. 664.—1878, Linstow, Compend. d. Helm., p. 177.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 52.

Physaloptera dentata Linstow.

1883, Linstow, Arch. f. Naturg., pp. 282-283, Pl. vi., figs. 9, 10.—1886, Linstow, Helminths; in Fedtschenko, Travels in Turkestan, Pt. 18, v. 2, Zoogeog. survey, Moscow, p. 7, figs. 9-10.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 39.—1895, Linstow, Arch. f. Micr. Anat., xliv., p. 525.—1917, Seurat, C.R. Soc. biol., Paris, lxxx., p. 47.

Physaloptera leptosoma (Gervais) Seurat.

1848, *Strongylus leptosomus* Gervais, Ann. Sci. Nat., 3rd ser., x., p. 204.—1851, Diesing, Syst. Helm., ii., p. 321.—1878, Linstow, Comp. d. Helm., p. 195.—1882, Fraipont.—1917, *Physaloptera leptosoma*, Seurat, C.R. Soc. biol., Paris, lxxx., pp. 48-52, figs. 1-4.

Physaloptera monodons Molin.

1860, Molin, Sitz. k. Akad. Wien, xxxix., pp. 658-659.—1878, Linstow, Compend. d. Helm., p. 185.—1882, Drasche, Verh. Zool-bot. Ges. Wien, xxxii., p. 127, tab. viii., figs. 8-10.—1889, Linstow, Comp. d. Helm., Nacht., p. 64.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 50.

Physaloptera mucronata Diesing.

1851, Diesing, Syst. Helm., ii., p. 235.—1860, Diesing, Sitz. k. Akad. Wiss. Wien, xlii., (Revis. d. Nemat.), p. 653.—1857, Diesing, Denks. k. Akad. Wiss. Wien, xiii., p. 16, tab. ii., figs. 17-28.—1856, Leidy, Proc. Acad. Philad., viii., p. 53.—1860, Molin, Sitz. k. Akad. Wiss. Wien, xxxix., p. 641 (*Ascarid.*).—1860, *Ascaris lanceolata*, Molin, Sitz. k. Akad. Wiss. Wien, xl., p. 334.—1878, *Physaloptera mucronata*, Linstow, Compend. d. Helm., p. 180.—1882, Drasche, Verh. Zool.-bot. Ges. Wien, xxxii., pp. 128, 134.

Physaloptera obtusissima Molin.

1860, Molin, Sitz. k. Akad. Wiss. Wien, xxxix., pp. 654-657.—1878, Linstow, Compend. d. Helm., p. 182.—1882, Drasche, Verh. Zool.-bot. Ges. Wien, xxxii., p. 127, tab. viii., figs. 13-14.—1889, Linstow, Comp. d. Helm., Nacht., p. 63.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 44.—1900, Shipley, Willey's Zool. Results, v, p. 559.—1912, Johnston, Proc. Roy. Soc. Q'land, xxiii., p. 236.

Physaloptera pallaryi Seurat.

1917, Seurat, C.R. Soc. biol., Paris, lxxx., pp. 45-47.

Physaloptera paradora Linstow.

1908, Linstow, Jena Denkschr. Med. Ges., xiii., p. 22.—1914, Seurat, C.R. Soc. biol., lxxvii., p. 434-436, figs. 1, 4, 5.—1917, Seurat, C.R. Soc. biol., Paris, lxxx., p. 47. (*Physaloptera varani*).

Physaloptera quadrovaria Leiper.

1908, Leiper, Rep. Wellcome Res. Lab., iii., p. 192, fig. 43.—1917, *Physaloptera varani*, Seurat, C.R. Soc. biol. Paris, lxxx., p. 47.

Physaloptera retusa Rudolphi.

1658, *Lumbrici Iguanae,* Piso, De Indiae utriusque re naturali et med., p. 105.—1819, *Physaloptera retusa,* Rudolphi, Synops., pp. 30, 258, 646.—1845, *Spiroptera retusa,* Dujardin, Hist. Nat. d. Helm., p. 104.—1851, *Physaloptera retusa,* Diesing, Syst. Helm., ii., p. 236.—1860, Molin, Sitz. k. Akad. Wiss. Wien. xxxix., pp. 652-654.—1866, Schneider, Monog. d. Nemat., p. 65, Pl. iii., figs. 6, 8, 9, and text-fig.—1878, Linstow, Compend. d. Helm., p. 191.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 37.—1900, Shipley, Willey's Zool. Results, v., p. 559.—1912, Johnston, Proc. Roy. Soc. Q'land, xxiii., p. 236.—1917, Seurat, C.R. Soc. biol., Paris, lxxx., p. 43.

Physaloptera sonsinoi Linstow.

1895, Linstow, Arch. f. Mier. Anat., xliv., pp. 525-526, tab. xxx., fig. 17.—1917, Seurat, C.R. Soc. biol., Paris, lxxx., p. 52.

Physaloptera spiralis Schneider.

1866, Schneider, Monogr. d. Nemat., pp. 64-65, tab. iii., fig. 5, and text-fig.—1878, Linstow, Comp. d. Helm., p. 191.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., p. 38.

Physaloptera striata Linstow.

1883, Linstow, Arch. f. Naturg., pp. 280-281, tab. vi., figs. 5-6.—1889, Linstow, Comp. d. Helm., Nacht., p. 64.—1886, Linstow, Worms; Travels, Fedtschenko, (Jav. russ.). Moscow, p. 5, figs. 5-6.—1889, Stossich, Boll. Soc. Adriat. Sc. Nat. Trieste, xi., pp. 40-41.

Physaloptera varani Parona.

1890, Parona, Ann. Mus. Genova, Ser. 2, vii., (xxvii.), p. 776, tab. iii., fig. 16.—1895, Linstow, Arch. f. Mikr. Anat., xliv., p. 526.—1900, Shipley, Willey's Zool. Results, v., p. 560.—1908, *Physaloptera paradoxa,* Linstow, Jena Denkschr. Med. Ges., xiii., p. 22.—1908, *Physaloptera quadrovaria* Leiper, Rep. Wellcome Res. Lab., iii., p. 192, fig. 43.—1917, *Physaloptera varani,* Seurat, C.R. Soc. biol., Paris, lxxx., pp. 47-48.

Physaloptera sp.

1890, Parona, Ann. Mus. Genova, Ser. 2, vii., (xxvii.), pp. 775-776.

Physaloptera spp.

1871, Krefft, Trans. Ent. Soc. N.S.W., ii., p. 214.—1912, Johnston, Proc. Roy. Soc. Q'land, xxiii., p. 237, 242.

Physaloptera sp. (*varani?*)

1909, Johnston, Journ. Roy. Soc. N.S.W., xliii., p. 115.—1910, Johnston, Rep. Bur. Microbiol. N.S.W., i., p. 88.—1912, Johnston, Proc. Roy. Soc. Q'land, xxiv., pp. 65, 87.—1912, Johnston, *Ibid.,* xxiii., p. 242.—1916, Johnston, Proc. Roy. Soc. Q'land, xxviii., p. 57.

Physaloptera spp.

1910, Johnston, Journ. Roy. Soc. N.S.W., xliv., abstract, pp. xi., xviii.—1910, Johnston, Proc. Linn. Soc. N.S. Wales, p. 309.—1910, Johnston, Proc. Linn. Soc. N.S. Wales, p. 524.—1912, Johnston, Proc. Roy. Soc. Q'land., xxiii., p. 236-243.

Physaloptera sp. ? v. Sieb.

1882, Orley, Ann. Mag. Nat. Hist., ser. 5, vol. ix., p. 311.

Physaloptera sp.

1897, Linstow, Arch. f. Naturg., lxiii., p. 281.

Thubunaca pudica gen. et sp. n.

1914, Seurat, C.R. Soc. biol., Paris, lxxvi., pp. 724-727, 4 figs.

Literature.

Diesing, K. M. 1851.—Systema helminthum. Vindobonae. Vol. ii., pp. 232-237, 435-439.

————, 1857.—Sechzehn Arten von Nematoideen. *Denk. Akad. Wiss. Wien, Math.-Naturw. Cl.*, xiii., 1 Abt., pp. 6-26, Pl. 2, figs. 17-28.

———— 1861.—Revision der Nematoden. *Sitz. Akad. Wiss. Wien, Math-Naturw. Cl.* (1860), xlii., p. 652.

Drasche, R. von, 1882.—Revision der in der Nematoden-Sammlung des k.k. zoologischen Hofcabinetes befindlichen Original-Exemplare Diesing's und Molin's. Verh. zool.-bot. Ges. Wien, xxxii., pp. 117-138.

Dujardin, F., 1845.—Histoire naturelle des helminthes ou vers intestinaux. *Paris*, p. 83.

Gedoelst, L., 1916.—Notes sur la faune parasitaire du Congo belge. *Rev. Zool. Africaine*, Brusselles, v., pp. 1-90.

Johnston, T. H., 1909 *a*.—On a new reptilian Cestode. *Journ. Roy. Soc. N.S. Wales*, xliii., pp. 103-116.

———— 1910 *b*.—Notes and Exhibits. *Proc. Linn. Soc. N.S. Wales*, xxxiv., p. 590.

———— 1910 *a*.—On a new reptilian Cestode. *Rep. Bureau Microbiol., N.S.W.*, 1909, 1, p. 88.

———— 1910 *b*.—Notes and Exhibits. *Proc. Linn. Soc. N.S. Wales*, xxxv., p. 309, 524.

———— 1910 *c*.—Notes and Exhibits. *Journ. Roy. Soc. N.S. Wales*, xliv., p. xi, xviii.

———— 1912 *a*.—A census of Australian reptilian Entozoa. *Proc. Roy. Soc. Queensland*, xxiii., pp. 234-249.

———— 1912 *b*.—Notes on some Entozoa. *Proc. Roy. Soc. Qland*, xxiv., pp. 63-91.

———— 1916.—A census of the Endoparasites recorded as occurring in Queensland, arranged under their hosts. *Proc. Roy. Soc. Qland*, xxviii., pp. 31-79. Reptilia, pp. 56-59.

Krefft, G., 1871.—On Australian Entozoa, with descriptions of new species. *Trans. Ent. Soc. N.S. Wales*, ii., pp. 206-232.

Leidy, J., 1856.—A synopsis of Entozoa and some of their ectocongeners observed by the author. *Proc. Acad. Nat. Sci. Philad.*, viii., (1), pp. 42-58.

Leiper, R. T., 1908.—An account of some helminthes contained in Dr. C. M. Wenyon's collection from the Sudan. *Rep. Wellcome Research Lab., London*, iii., pp. 187-199, Pls. 21-22, figs. 44-50.

Linstow, O. von, 1878.—Compendium der Helminthologie. *Hannover*, pp. 177-196.

———— 1883.—Nematoden, Trematoden und Acanthocephalen, gesammelt von Prof. Fedtschenko in Turkestan. *Arch. Naturg.*, xlix., pp. 274-314, Pls. 6-9, figs. 1-52.

———— 1889.—Compendium der Helminthologie. Nachtrag. Die Litteratur der Jahre 1878-1889. *Hannover*. pp. 63-68.

——— 1895.—Untersuchungen an Nematoden. *Arch. Mikr. Anat.*, pp. 509-533, Pl. 30.

——— 1899.—Nematoden aus der Berliner zoologischen Sammlung. *Mitt. zool. Samml. d. Mus. f. Naturk. Berl.*, i (2), pp. 1-28, 6 Pls.

——— 1906.—Helminthes from the collection of the Colombo Museum. *Spolia Zeylanica*, iii., pp. 163-188, 3 Pls.

——— 1908.—Helminthes. Nematoden und Acanthocephalen. (In L. Schultze, Zool. u. Anthrop. Ergeb. e Forschungsreise in Sud Africa. Bd. 1, Leif. 4.). *Denk. med. Ges., Jena*, xiii., pp. 19-28, 1 Pl.

Molin, R., 1860.—Una monografia del genere Physaloptera. *Sitz. Akad. Wiss. Wien, Math.-Naturw., Cl.*, xxxix., pp. 637-672.

Parona, C., 1890.—Sopra alunei elminti di vertebrati birmani raccolti da Leonardo Fea. *Ann. Mus. Genova*, ser. 2, vii., (xxvii.), pp. 765-780, Pl. 3.

——— 1907.—Nuove specie di nematodi africani. (Nota preventiva). (Spedizione al Ruwenzori di S.A.R. Luigi Amedeo di Savoia, Duca degli Abruzzi. 24.) *Boll. Mus. zool. ed anat. compar., Torino* (566), xxii., 4 pp.

——— 1912.—L' elmintologia italiana da suoi primi tempi all 'anno 1910. Vol. i. Bibliografia. Vol. ii. Storia, sistematica, corologia.

Rudolphi, C. A., 1819.—Entozoorum synopsis cui accedunt mantissa duplex et indices locupletissimi. *Berolini.*

Schneider, A., 1866.—Monographie der Nematoden. *Berlin*, pp. 59-65, 341.

Seurat, L. G., 1914.—Sur un nouveau Nématode parasite des Reptiles. *Compt. rend. Soc. biol., Paris*, lxxvi., pp. 724-727, 4 figs.

——— 1914 *b*.—Sur deux Physaloptères tetrahystériens des Reptiles. *Compt. rend. Soc. biol., Paris*, lxxvii., pp. 433-436.

——— 1917.—Physaloptères des reptiles du Nord-Africain. *Compt. rend. Soc. biol., Paris*, lxxx., pp. 43-52.

Shipley, A. E., 1900.—A description of the Entozoa collected by Dr. Willey during his sojourn in the Western Pacific. *Willey's Zool. Results based on material from New Britain, New Guinea, Loyalty Islands, etc.* Pt. v., pp. 531-568.

Stossich, M., 1889.—Il genere Physaloptera Rudolphi. Lavoro monografico. *Boll. Soc. Adriat., Trieste*, xi., pp. 36-59, 3 Pls.

——— 1902.—Sopra alunei nematodi della collezione elmintologica del prof. dott. Corrado Parona. *Boll. Mus. zool. e anat. comp., Genova*, No. 116. 16 pp., 3 Pls.